

**“How to Use  $\mu$ LED Optoelectrodes: Surgery, Data Collection and  $\mu$ LED Control” – Webinar Q&A**

- 1. At what speed is it best to implant the probes to prevent bending of the shanks or dimpling of dura/tissue?**
  - a. When you penetrate the brain, the best practice is to just go up and down until all the shanks can penetrate. There is a recent paper that showed 2  $\mu$ m/second speed is the best speed to obtain good quality recordings. As a rule of thumb, we generally reach the hippocampus in 30-60 minutes in acute recording, 1.2mm in a mouse and 2.2mm in a rat.
  
- 2. Can chronic optoelectrodes be longer than 5mm? Was 5mm just an example?**
  - a. As of now it is only 5mm. Professor Yoon asked everyone to send their wishes directly. They are going to change the current design and could potentially incorporate longer shanks.
  
- 3. What kind of printer and material do we need to use the drive?**
  - a. We use the Form Labs Form 2 printer, the most typical resin which comes in many different colors. These are available on our Github page or we can send you the files directly.
  
- 4. Would this setup also be possible for awake recordings?**
  - a. Yes. The microdrive option that was showed, once you build up the Faraday cage you can protect the probe and the animal can move around. You can lower the probe day by day and then collect the data as long as you have good quality and signal.
  
- 5. Are the micro LED probes stronger than other silicon probes? easy to be handle?**
  - a. It is the same as silicon probes.
  
- 6. What is the length of the implantation procedure? And has this been used in rats as well, or only mice?**
  - a. Really depends on surgical skills and location, implanting the probe at an angle, etc. I would say something between 3-6 hours depending on the complexity of the surgery. Yes, it has been used in both rats and mice.
  
- 7. How many times can we re-use these probes?**
  - a. The acute probe has already been used 7 times and it is still working. If you are careful with insertion and cleaning, I think an acute probe can be reused multiple times, at least 4-5 times. In a chronic animal it has its own complications. All of these are technically meant to be used a single time, but it is possible to reuse them.
  
- 8. Can you talk about how and where you tie the  $\mu$ LED ground to the recording ground in current vs voltage mode, if you ever tie them together at all?**
  - a. There are two tiny pads on the PCB where you can put a zero ohm resistor or just tie them together.
  
- 9. What "biocompatible silicone" do you recommend for sealing the craniotomy?**
  - a. All the chemicals used in our surgeries can be found on the Yoon group Github page. There is only one particular silicone that will not break the microLED probes, or you can use a paraffin wax mineral oil mixture that we have used in the past for many years.

- 10. Are there examples of acute recordings in an awake animal?**
  - a. Yes, upcoming speakers in the webinar series will discuss this type of recording.
  
- 11. Have you tried recording without the copper mesh faraday cage?**
  - a. In acute recordings it is possible to get good quality signal without the copper mesh Faraday cage, you would need to have a good recording room. In chronic animals, the cage also acts as a mechanical protection.
  
- 12. What was the UV curable dental cement you used during the surgery?**
  - a. Also, can be found on the Github page, it's called Unifast LC, LC stands for Light Cure.
  
- 13. I think they are asking if anyone has performed acute recordings in headfixed mice, like what has been done with Neuropixel probes.**
  - a. You can penetrate to a new spot each day; the acute probe is the best for this purpose.
  
- 14. How does the copper mesh act as a faraday cage given it is open at the top and bottom? Surely a faraday cage is a complete (i.e. no gaps) electromagnetic shield?**
  - a. It is grounded to the system ground. Yes, it is not a perfect Faraday cage, it is better than nothing. For rats we cover the preamplifier with another piece of copper mesh, so the top is fully covered.
  
- 15. Is internal body heat a factor in the accuracy of the data obtained by the probe?**
  - a. Internal body heat will always affect neuronal activity.
    - i. The effect is independent of recording device.
  
- 16. Can  $\mu$ LED optoelectrode heat brain tissue?**
  - a. Not really
    - i. The amount of light we are using is very low.
    - ii. Silicon is a very good heat conductor.
  - b. But keep in mind that long (> 10 s), continuous light stimulation can heat brain tissue.
  
- 17. What is the best way to clean these probes?**
  - a. Chemical cleaning
    - i. Overnight DI water
    - ii. Overnight contact lens solution
    - iii. Overnight DI water
  - b. Mechanical cleaning
    - i. Removing tissue particles with needle
    - ii. Insert probe into phantom brain